Silicon Controlled Rectifiers and UPS

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Silicon Controlled Rectifiers and How They Affect Your Standby Load Profile

The load profile found in today's hospitals, offices, and public buildings requires very high-quality power. However, non-linear loads caused by variable-speed drives or older or inferior uninterruptible power supplies (UPS) serving data processing systems can greatly affect line current and voltage. While utility power can often accommodate these effects, standby generating systems can be greatly affected if they are undersized or designed incorrectly.

The cause of many non-linear load problems result from silicon-controlled rectifiers (SCR) used in systems to convert AC to DC Power. These devices inherently affect the system's sine wave form. If the distortion is great enough, the genset cannot adequately maintain voltage and frequency regulation. The genset engine speed will vary, attempting to seek the correct rpm to meet the load requirements. This can set up further line disturbances that can affect connected loads. It also creates excessive heat in the generator and may create heating in SCRs.

Solutions to SCR Concerns

The simplest way to handle non-linear load concerns today in data processing and computer centers is to use either a CAT Rotary UPS or a Mitsubishi 5th-Gen IGBT UPS. Both of these products have so little affect on sine wave, they allow for genset sizing equal to the UPS rating. Both have advantages and disadvantages, but either will eliminate your sine wave concerns and enjoy the same world class support from Cashman Power Solutions we apply to our generators. See our sheet titled "Power Quality" for more details. For systems with existing equipment, here are some tips:

Sizing Criteria

Sizing criteria used in the past for gensets and transformers are not adequate for the non-linear loads found in today's load profiles. The following is a method to better size for these loads:

1. Establish UPS and/or non-linear load input kW. The UPS input kW is equal to its output, divided by the UPS and/or non-linear load input kW. The UPS input kW is equal to its output, divided by the UPS efficiency, plus any battery recharging that takes place while the genset is operating.
2. Multiply the kW by the following k-factors if:
   The genset will ONLY power the UPS or non-linear load system:

Pulse Rectifier system	k-factor
6	1.6
12	1.4

   The genset will power UPS/non-linear loads AND other loads:

Pulse Rectifier system	k-factor
6	1.15
12	1.10

3. Add the resulting kW rating based on the k-factor to the kW needed for additional loads (if applicable) to determine the minimum kW rating for a genset.
4. Keep in mind SCR-based UPS sine wave effects increase as load decreases. So, a partially loaded unit will exacerbate this situation. Line filters can help but will not completely eliminate most distortion and will reduce system efficiency.

Don't Forget Motor Starting

Because of high motor skVA, it's imperative to include these in your sizing exercise or develop a strategy to minimize its effect on the total motor load.